

FINAL

**LOWER TAILINGS PILE
TECHNICAL MEMORANDUM**

**CARPENTER-SNOW CREEK MINING DISTRICT NPL SITE
SUPPLEMENTAL STUDIES FOR THE REMEDIAL INVESTIGATION
CASCADE COUNTY, MONTANA**

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Prepared for:

Montana Department of Environmental Quality
Remediation Division
P.O. Box 200901
Helena, Montana 59620

U.S. Environmental Protection Agency – Region 8
10 West 15th Street
Helena, Montana 59626

Prepared By:

Tetra Tech EM Inc.
7 West 6th Avenue, Suite 612
Helena, Montana 59601
(406) 442-5588

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CLP	Contract Laboratory Program
CSCMD	Carpenter Snow Creek Mining District
DEQ	Montana Department of Environmental Quality
EPA	United States Environmental Protection Agency
GPS	Global Positioning System
LTP	Lower tailings pile
Maxim	Maxim Technologies Inc.
mg/kg	Milligrams per kilogram
NPL	National Priorities List
RI	Remedial Investigation
SOP	Standard Operating Procedure
Tetra Tech	Tetra Tech EM Inc.
USFS	United States Forest Service
UTP	Upper tailings pile
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ), in cooperation with the U.S. Environmental Protection Agency (EPA) and the U.S. Forest Service (USFS), tasked Tetra Tech EM Inc. (Tetra Tech) to complete a supplemental remedial investigation (RI) at the Carpenter-Snow Creek Mining District (CSCMD) National Priorities List (NPL) site. The CSCMD site is in Cascade County, and occupies an area from approximately 4 miles northeast of Neihart, Montana, continuing southwest through town and continuing just southwest of Neihart (Figure 1-1). There are mine tailings, waste rock, and acid mine drainage throughout the site. Previous investigations showed that the waste rock and tailings contain elevated concentrations of arsenic, cadmium, copper, lead, and zinc and they may pose a risk to ecological receptors from surface water, groundwater, soil, and sediment, and to human recreational and residential users. Remediation of the site will be necessary if concentrations of contaminants in tailings, soil, and groundwater pose unacceptable risks to human health or ecological receptors.

Supplemental RI tasks completed include evaluating the suitability of potential repository locations; determining the extent and volume of Carpenter Creek streamside tailings and tailings piles; measuring metals concentrations in roadbed materials, background soils, and residential soils; installing and sampling groundwater wells; and conducting a screening assessment of metals in streamside sediments along Carpenter, Snow, and Belt Creeks, and the drainages east of Neihart.

Tetra Tech prepared this technical memorandum for the DEQ under Contract Number 407026, Task Order 87, to begin to summarize the extent and volume of the lower tailings pile (LTP) for the CSCMD site. This technical memorandum includes an estimate of the extent and volume of the upper tailings pile (UTP) for the CSCMD site. The UTP volume estimate was prepared using information obtained from a previous investigation. The extent of stream side tailings above and below the tailings piles is summarized in the Carpenter Creek Tailings Technical Memorandum. Other supplemental RI tasks are summarized in separate technical memoranda.

The remainder of this technical memorandum contains:

- A summary of the site history for the areas of interest.
- A description of field activities and the methods used for gathering data in both tailings pile areas.
- The analytical results of metals in the LTP and modeling methods used to determine volumes.

2.0 SITE HISTORY

The Neihart Mining District was a major silver producer in Montana and the primary producer in Cascade County, producing about \$16 million in silver between 1882 and 1929 (Sahinen 1935; GCM 1991). The first claim in the district was made in July 1881. Development slowed during the mid- to late 1880s, then began to increase again after construction of the Great Falls smelter and the Belt Mountain branch of the Great Northern Railroad in 1891 that connected Neihart to Great Falls.

In 1921, the Silver Dyke Mine began operations. One million tons of ore were blocked out and a 500-ton flotation mill was constructed on the site. The Silver Dyke operated at capacity throughout the decade. In 1926, the capacity of the mill at the Silver Dyke was increased to 950 tons. The Silver Dyke operated until 1929, when the blocked-out ore was depleted and no new deposits could be found. During its operation, the Silver Dyke was the largest producer of ore in the Neihart mining district, and its silver production was second only to Silver Bow County (Schafer 1935).

A 1925 earthquake damaged the tailings dam next to the Silver Dyke Mill causing a flood of tailings into the valley below. These tailings are now known as the Silver Dyke Tailings. The tailings were deposited below the mill along Carpenter Creek. In the wake of the tailings dam breach, two new tailings ponds were constructed to hold the tailings from the Silver Dyke Mill. These tailings ponds are now referred to as the UTP and the LTP (Figure 2-1). The tailings piles are approximately half a mile northeast of the intersection of Snow Creek and Carpenter Creek. Both piles are covered with minimal vegetation and are composed of clayey to fine sand tailings. Tetra Tech was tasked with characterizing the LTP.

Characterization included: (1) detailed topographic survey, (2) installation of soil borings and test pits, (3) using X-Ray Fluorescence (XRF) to complete analysis of in situ soil and ex situ sieved samples to determine metals concentrations, and (4) development of a model to estimate the volume of the LTP.

3.0 METHODS

The following sections describe the methods used for the LTP assessments.

3.1 TOPOGRAPHIC SURVEY

A topographic survey of the LTP was done in September, 2011 by Morrison Maierle Engineering under the supervision of a professional land surveyor. Tetra Tech used the results obtained from Morrison Maierle to develop a computer model to accurately represent the surface area encompassed by the LTP. This data was used in developing a 3-dimensional model of the area and determining tailings volumes.

3.2 LTP DETAILED ASSESSMENT

In situ XRF analysis of the surface soil was completed and surface soil (0-6 inches below ground surface [bgs]) samples and subsurface soil samples were collected for the detailed assessment of the LTP. The subsamples were collected from soil borings and test pits. All soil samples were collected as described in the Final Sampling and Analysis Plan (Tetra Tech, 2011) and SOP 005 (Tetra Tech 2009). In situ XRF measurements of the uppermost surface soil were completed by: (1) clearing the surface of debris and vegetation, (2) packing the soil, (3) covering the soil with a thin piece of plastic, (4) making the XRF measurement, and (5) recording location with a handheld global positioning system receiver (GPS). The ex situ surface and subsurface soil samples were approximately 500 grams and screened with a #10 sieve before XRF analysis. All samples were analyzed by XRF in accordance with EPA Method 6200 (EPA, 2007). Ten percent of the 10 mesh sieved samples (4 of 36 samples) were analyzed for total recoverable metals at a CLP laboratory.

The LTP covers approximately 12 acres above the confluence of Carpenter Creek and Snow Creek. To properly characterize the extent of contamination, 114 in situ XRF measurements were completed and used to select 33 surface soil sampling locations (Figure 3-1). Sample transects were evaluated from within the known extent of tailings outward until no tailings were observed (Figure 3-2). The procedure used to determine where to collect individual soil samples was: (1) select an area of visible tailings and analyzed in situ by XRF, (2) move perpendicular to the edge of the LTP outward to a visually unimpacted area and completed an in situ XRF measurement, and (3) repeat until the XRF results indicated a significant decrease in concentration of the metals of concern. A grab sample was collected at the point of decreased contamination for further XRF analysis. The in situ measurements were completed to identify the location where lead concentrations dropped below 800 milligrams per kilogram (mg/kg). At locations LTP-SS-SS08b, LTP-SS-SS11b, LTP-SS-SS19c, LTP-SS21f, LTP-SS22d, and LTP-SS24c the contamination extended beyond the visually identifiable extent of tailings. No ex situ sample was collected from transect 23 due to the large wetland area east of the LTP (Figure 3-2). Four duplicate analyses were completed on the 36 10 mesh samples.

To measure the depth of tailings in the LTP, 8 soil borings and 11 test pits were installed (Figure 3-3). Soil borings were installed with a hollow stem auger in areas where tailings were anticipated to extend beyond the reach of a backhoe. Multiple samples were recovered from each of the boreholes but only one sample from each location was sieved and analyzed by XRF. Many of the samples collected from the boreholes were mostly rock and unsuitable for XRF analysis. Any samples that were clearly recognized as tailings were not analyzed. Monitoring wells MW-5 and MW-6 were installed in two of the soil boring

locations. Field logs for all test pits and soil borings are in Appendix B. The locations of the soil boring and test pit were recorded with a handheld GPS. The results gathered from the soil samples were used to create a 3-dimensional model of the tailings surface in AutoCAD Civil 3D 2011.

4.0 ANALYTICAL RESULTS

The following section discusses the analytical soil screening results that were obtained during the investigation of the LTP.

4.1 LTP SCREENING ASSESSMENT

One hundred fourteen in situ surface soil XRF measurements and 34 shallow surface soil (0-6 inches bgs) samples were collected from the LTP and analyzed for arsenic, cadmium, copper, lead, and zinc (Table 4-1). All cadmium XRF results were nondetect. Table 4-2 contains results for the samples collected from test pit and boreholes. XRF analysis was performed on all samples and six of the samples were sent to a CLP laboratory for analysis of total recoverable metals. CLP laboratory results for the metals of concern are highlighted in orange in Tables 4-1 and 4-2. Complete, unmodified sample results for XRF and CLP analysis are in Appendix A.

4.1.1 Surface Soil Samples

One hundred fourteen in situ surface soil XRF analyses were completed in areas suspected to be tailings and 34 shallow surface soil samples were collected from near the LTP. After the sample locations were identified using in situ measurements, samples were collected for further analysis. The samples were analyzed in the field after being sieved with a 10 mesh screen and then brought back to the office for another XRF analysis. XRF results are in Table 4-1. Four of the samples were sent to a CLP laboratory for a total recoverable metals analysis and are presented in Table 4-1. Results from the CLP analysis are consistent with XRF results.

In Table 4-1, the sample names are structured so that LTP stands for the lower tailing pile, SS stands for surface sample, the two-digit number represents the transect, and the last letter indicates the order of sample collection within the transect. This numbering system was not described in the Sampling and Analysis Plan but was adopted in the field to provide clarity and consistency for naming the in situ XRF measurements. Sample names with an “a” represent the first sample collected on a transect and were collected from an area with visible tailings and no vegetation. The exceptions were transect 5 where the first sample was offset from the first sample in transect 4 (Figure 3-2) and transect 20 that was northeast of the bridge over Carpenter Creek. The “a” samples had copper concentrations ranging from 114 mg/kg

(transect 20) to 2,950 mg/kg (transect 7) with an average of 1,295 mg/kg. The lead concentrations ranged from 304 mg/kg (transect 20) to 8,763 mg/kg (transect 7) with an average of 4,135 mg/kg. The zinc concentrations ranged from 184 mg/kg (transect 20) to 2,242 mg/kg (transect 32) with an average of 891 mg/kg.

The “b” through “j” samples were collected at increasing distance from the LTP. Transects 5 through 19 were constrained by the Carpenter Creek road. In general, samples collected from the road bank at elevations higher than the surface of the tailings pile contained copper, lead, and zinc at concentrations less than the “a” sample. Transects 21 through 23 were between the UTP and LTP. The data from transects 21 through 23 indicate that there is a continuous layer of tailings between the tailings piles. Transects 24 through 30 are on the slope southeast of the LTP. High concentrations of metals (lead up to 29,530 mg/kg) were found up hill from the LTP. The tailings are present as a continuous layer under the lodgepole pine trees from the top of the tailings pile to the Snow Creek road. At transects 26 and 27 lead concentrations were 20,783 mg/kg (LTP-SS26h), 14,031 mg/kg (LTP-SS26i), and 29,530 mg/kg (LTP-SS27e) southeast and uphill from the Snow Creek road. Samples collected from the slope at depths from 6-12 inches bgs indicate that the tailings are more than 1 foot thick. Transects 1 through 4 and 31 through 34 are southwest and downstream from the LTP. The analytical results suggest that the topographically higher benches represented by transects 1 through 4, 31, and 34 limit the migration of tailings. Even through transects 32 and 33 cross wetland areas there does not appear to be significant southwestern migration of tailings.

4.1.2 Test Pit and Borehole Samples

Subsurface soil samples were collected at the LTP from 10 of 11 test pits and 8 boreholes. One sample was collected from each test pit except for TP-02 that collapsed too quickly for sample collection. All samples from the test pits were collected from the gravelly deposits under the fine grained tailings. Multiple samples were recovered from each of the boreholes but only one sample from each location was sieved and analyzed by XRF. Many of the samples collected from the boreholes were mostly rock and unsuitable for XRF analysis. Any samples collected from the boreholes that were clearly recognized as tailings were not analyzed. Results for the metals of concern are in Table 4-2. Ten percent of the samples were sent to a CLP laboratory to be analyzed for total recoverable metals. CLP results are highlighted in orange in Table 4-2 and were consistent with XRF results.

The results for the soil borings indicate that, except for the soil sample collected from monitoring well MW-06, all the soil samples contained much lower concentrations of metals than the tailings surface soil samples (“a” samples). The sample results may be used to define the lower extent of contamination.

5.0 MODELING RESULTS

The following sections discuss the estimations of volumes and areas based on the models created for the LTP and UTP areas.

5.1 LOWER TAILINGS PILE

The LTP was modeled using AutoCAD Civil 3D 2011. The survey data was used to create a 3-dimensional model of the LTP. The survey that was provided did not include any of the tailings pile area on the north side of Carpenter Creek. In order to get a more accurate model of the area, the GPS points obtained during the XRF sampling were incorporated into the model to extend the existing ground surface across Carpenter Creek. Consequently, the model that was generated may have minor inaccuracies due to the less precise nature of the handheld GPS used to record sample locations and elevations. The lack of survey data on the north side of Carpenter Creek constitutes a data gap that will need to be addressed during the next field season. Once the existing surface model was finalized, the information obtained from the test pits and soil borings was incorporated to establish a second surface representing depth of the tailings. Areas that did not have test pit data were estimated based on the depth of tailings in surrounding areas. Figure 5-1 shows the final model used to calculate the tailings volume for the LTP.

The model calculated the LTP volume to be 176,000 cubic yards. This represents the total volume of tailings that would need to be removed from the area to re-establish the approximate original ground surface. This volume, along with surface areas of the existing ground and tailings area and the volume of potential extra excavation are in Table 5-1. Extra excavation may be required for areas where the tailings are mixed with the underlying gravels.

5.2 UPPER TAILINGS PILE

The UTP was modeled with AutoCAD Civil 3D 2011 using information obtained from Maxim Technologies, Inc. (Maxim) 2002. The previous work was completed under a task titled Carpenter Creek/Snow Creek Site Investigation (Maxim 2002). This information included a detailed survey of the area and tailings depth information from multiple soil borings and test pits. Since the survey used to create the model of the UTP was completed in 2002, it is likely that current conditions are relatively similar to what was previously observed. To account for possible discrepancies, a current aerial photograph of the UTP was referenced during the modeling work to create a more accurate ground surface model. After completion of the ground surface model, a second surface representing the depth of tailings in the UTP was created based on soil boring and test pit information. This surface was compared

to a previous model completed in 2002 to verify that the extent of contamination was properly represented. The final model used to calculate the volume of tailings in the UTP is in Figure 5-1.

The model calculated the UTP volume to be 91,000 cubic yards. Table 5-1 has this volume, the surface area of the UTP, and the volume of extra material that may need to be excavated during a removal project. Extra excavation may be required for areas where the tailings are mixed with the underlying gravels.

6.0 CONCLUSIONS AND SUMMARY

Soil sampling of the LTP was completed in August and September 2011. The investigation consisted of sampling to determine the areal and vertical extent of tailings in the tailings pile and the extent of contamination in the area. The areal extent of contamination was characterized through 114 in situ XRF measurements and the collection of 33 surface soil samples. The thickness of the tailings was determined by installing test pits and boreholes throughout the surveyed area. This information was coupled with a detailed survey of the tailings pile to create a 3-dimensional model of the LTP and calculate an estimated volume of contaminated material. A model of the UTP was created using surface and subsurface soil sample results and a topographic survey obtained from a previous investigation. Models of the LTP and the UTP are in Figure 5-1. The estimated removal volumes are 91,000 cubic yards for the UTP and 176,000 cubic yards for the LTP.

7.0 REFERENCES

- GCM Services, Inc. 1991. Cultural Resource Inventory and Assessment of the Neihart Mining District. Prepared for L.C. Hanson Company. Butte.
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- Tetra Tech. 2011. Final Sampling and Analysis Plan, Carpenter Snow Creek Mining District National Priorities List (NPL) Site Supplemental Studies for the Remedial Investigation. August.
- Tetra Tech. 2012. Draft Background Sampling and Data Analysis Technical Memorandum for the Carpenter- Snow Creek NPL Site. March.
- United States Environmental Protection Agency (EPA). 2007. Method 6200 Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment. Revision 0. February.

TABLES

**TABLE 4-1
LOWER TAILINGS PILE SAMPLE RESULTS**

		Arsenic	Cadmium	Copper	Lead	Zinc
XRF Limits of Detection (mg/kg)		20	NC	21	22	29
Sample Number	Sample State	Results (mg/kg)				
07-103- LTP-SS01a	In situ	<LOD	<LOD	1,055	6,957	451
07-103- LTP-SS01b	In situ	<LOD	<LOD	926	2,024	884
07-103- LTP-SS01c	In situ	<LOD	<LOD	81	280	196
07-103- LTP-SS01c	10m sieve	<LOD	<LOD	104	272	172
07-103- LTP-SS02a	In situ	<LOD	<LOD	989	6,979	402
07-103- LTP-SS02b	In situ	51	<LOD	270	781	361
07-103- LTP-SS02c	In situ	<LOD	<LOD	70	154	223
07-103- LTP-SS02c	10m sieve	<LOD	<LOD	72	203	228
07-103- LTP-SS03a	In situ	<LOD	<LOD	1,660	3,673	601
07-103- LTP-SS03b	In situ	<LOD	<LOD	264	606	371
07-103- LTP-SS03c	In situ	<LOD	<LOD	105	188	239
07-103- LTP-SS03c	10m sieve	<LOD	<LOD	127	285	249
07-103- LTP-SS04a	In situ	<LOD	<LOD	747	3,727	496
07-103- LTP-SS04b	In situ	<LOD	<LOD	616	1,458	550
07-103- LTP-SS04c	In situ	<LOD	<LOD	496	917	389
07-103- LTP-SS04d	In situ	<LOD	<LOD	532	1,399	705
07-103- LTP-SS04e	In situ	<LOD	<LOD	228	356	440
07-103- LTP-SS04e	10m sieve	<LOD	<LOD	191	412	383
07-103- LTP-SS04eD	10m sieve	<LOD	<LOD	202	392	351
07-103- LTP-SS05a	In situ	<LOD	<LOD	174	559	334
07-103- LTP-SS05b	In situ	<LOD	<LOD	261	562	323
07-103- LTP-SS05c	In situ	<LOD	<LOD	58	353	341
07-103- LTP-SS05c	10m sieve	<LOD	<LOD	58	273	336
07-103- LTP-SS05c	10m sieve CLP	6.2	0.87	55.4	326	366
07-103- LTP-SS06a	In situ	<LOD	<LOD	2,677	7,956	2,075
07-103- LTP-SS06b	In situ	<LOD	<LOD	159	528	322
07-103- LTP-SS06b	10m sieve	<LOD	<LOD	234	800	383
07-103- LTP-SS07a	In situ	<LOD	<LOD	2,950	8,763	1,792
07-103- LTP-SS07b	In situ	<LOD	<LOD	170	783	334
07-103- LTP-SS07b	10m sieve	<LOD	<LOD	241	812	387
07-103- LTP-SS08a	In situ	<LOD	<LOD	1,489	4,526	1,091
07-103- LTP-SS08b	In situ	<LOD	<LOD	351	909	477
07-103- LTP-SS08b	10m sieve	<LOD	<LOD	370	1,009	416
07-103- LTP-SS09a	In situ	<LOD	<LOD	607	1,426	594
07-103- LTP-SS09b	In situ	<LOD	<LOD	423	1,213	742
07-103- LTP-SS09c	In situ	<LOD	<LOD	248	642	360
07-103- LTP-SS09c	10m sieve	<LOD	<LOD	259	575	322
07-103- LTP-SS10a	In situ	<LOD	<LOD	1,267	3,826	782
07-103- LTP-SS10b	In situ	<LOD	<LOD	129	519	292
07-103- LTP-SS10b	10m sieve	<LOD	<LOD	180	566	289
07-103- LTP-SS11a	In situ	<LOD	<LOD	390	1,084	330
07-103- LTP-SS11b	In situ	<LOD	<LOD	308	880	296

**TABLE 4-1
LOWER TAILINGS PILE SAMPLE RESULTS**

		Arsenic	Cadmium	Copper	Lead	Zinc
XRF Limits of Detection (mg/kg)		20	NC	21	22	29
Sample Number	Sample State	Results (mg/kg)				
07-103- LTP-SS11b	10m sieve	<LOD	<LOD	265	940	277
07-103- LTP-SS12a	In situ	123	<LOD	695	2,173	529
07-103- LTP-SS12b	In situ	<LOD	<LOD	281	775	319
07-103- LTP-SS12c	In situ	<LOD	<LOD	161	420	345
07-103- LTP-SS12c	10m sieve	<LOD	<LOD	104	435	294
07-103- LTP-SS12cD	10m sieve	<LOD	<LOD	144	489	309
07-103- LTP-SS13a	In situ	<LOD	<LOD	259	902	405
07-103- LTP-SS13b	In situ	<LOD	<LOD	142	514	262
07-103- LTP-SS13b	10m sieve	<LOD	<LOD	218	636	323
07-103- LTP-SS13b	10m sieve CLP	11.6	3.4	161	720	317
07-103- LTP-SS13c	In situ	<LOD	<LOD	127	420	256
07-103- LTP-SS14a	In situ	<LOD	<LOD	992	3,450	838
07-103- LTP-SS14b	In situ	<LOD	<LOD	288	707	432
07-103- LTP-SS14c	In situ	<LOD	<LOD	93	283	177
07-103- LTP-SS14c	10m sieve	<LOD	<LOD	72	300	159
07-103- LTP-SS15a	In situ	<LOD	<LOD	414	867	589
07-103- LTP-SS15b	In situ	<LOD	<LOD	197	425	248
07-103- LTP-SS15b	10m sieve	<LOD	<LOD	213	479	279
07-103- LTP-SS16a	In situ	<LOD	<LOD	603	2,424	754
07-103- LTP-SS16b	In situ	<LOD	<LOD	322	708	316
07-103- LTP-SS16b	10m sieve	<LOD	<LOD	336	796	307
07-103- LTP-SS17a	In situ	<LOD	<LOD	277	833	213
07-103- LTP-SS17b	In situ	<LOD	<LOD	55	295	170
07-103- LTP-SS17b	10m sieve	<LOD	<LOD	91	325	133
07-103- LTP-SS18a	In situ	<LOD	<LOD	2,077	6,829	1,348
07-103- LTP-SS18b	In situ	<LOD	<LOD	942	3,416	730
07-103- LTP-SS18c	In situ	<LOD	<LOD	83	271	189
07-103- LTP-SS18c	10m sieve	<LOD	<LOD	186	525	278
07-103- LTP-SS19a	In situ	<LOD	<LOD	1,005	5,125	544
07-103- LTP-SS19b	In situ	<LOD	<LOD	484	1,410	317
07-103- LTP-SS19c	In situ	<LOD	<LOD	348	869	217
07-103- LTP-SS19c	10m sieve	<LOD	<LOD	394	897	230
07-103- LTP-SS20a	In situ	<LOD	<LOD	147	463	311
07-103- LTP-SS20a	10m sieve	<LOD	<LOD	114	304	184
07-103- LTP-SS21a	In situ	<LOD	<LOD	1,581	4,356	1,291
07-103- LTP-SS21b	In situ	<LOD	<LOD	794	5,084	569
07-103- LTP-SS21c	In situ	<LOD	<LOD	638	2,628	480
07-103- LTP-SS21d	In situ	<LOD	<LOD	844	2,248	991
07-103- LTP-SS21e	In situ	<LOD	<LOD	555	2,033	1,299
07-103- LTP-SS21f	In situ	162	<LOD	818	2,377	1,526
07-103- LTP-SS21f	10m sieve	<LOD	<LOD	281	612	534
07-103- LTP-SS22a	In situ	<LOD	<LOD	2,014	7,844	1,589

**TABLE 4-1
LOWER TAILINGS PILE SAMPLE RESULTS**

		Arsenic	Cadmium	Copper	Lead	Zinc
XRF Limits of Detection (mg/kg)		20	NC	21	22	29
Sample Number	Sample State	Results (mg/kg)				
07-103- LTP-SS22b	In situ	<LOD	<LOD	1,090	4,122	961
07-103- LTP-SS22c	In situ	<LOD	<LOD	909	2,088	952
07-103- LTP-SS22d	In situ	<LOD	<LOD	846	1,293	399
07-103- LTP-SS22d	10m sieve	<LOD	<LOD	712	1,370	395
07-103- LTP-SS22e	In situ	<LOD	<LOD	606	5,683	801
07-103- LTP-SS22f	In situ	<LOD	<LOD	821	1,558	593
07-103- LTP-SS23a	In situ	<LOD	<LOD	1,302	3,080	1,245
07-103- LTP-SS23b	In situ	<LOD	<LOD	1,148	2,630	677
07-103- LTP-SS24a	In situ	<LOD	<LOD	359	1,073	394
07-103- LTP-SS24b	In situ	<LOD	<LOD	379	1,305	375
07-103- LTP-SS24c	In situ	<LOD	<LOD	527	1,502	409
07-103- LTP-SS24c	10m sieve	<LOD	<LOD	286	928	263
07-103- LTP-SS24cD	10m sieve	<LOD	<LOD	321	979	273
07-103- LTP-SS25a	In situ	<LOD	<LOD	2,292	5,757	1,682
07-103- LTP-SS25b	In situ	<LOD	<LOD	690	2,061	498
07-103- LTP-SS25c	In situ	<LOD	<LOD	129	554	187
07-103- LTP-SS25c	10m sieve	<LOD	<LOD	151	515	145
07-103- LTP-SS26a	In situ	<LOD	<LOD	1,797	5,206	1,597
07-103- LTP-SS26b	In situ	242	<LOD	1,579	4,559	657
07-103- LTP-SS26c	In situ	<LOD	<LOD	549	1,796	417
07-103- LTP-SS26d	In situ	<LOD	<LOD	682	2,133	349
07-103- LTP-SS26e	In situ	88	<LOD	314	1,355	189
07-103- LTP-SS26f	In situ	<LOD	<LOD	665	1,469	503
07-103- LTP-SS26g	In situ	<LOD	<LOD	1,272	5,781	600
07-103- LTP-SS26h	In situ	1,218	81	14,031	20,783	4,646
07-103- LTP-SS26i	In situ	403	<LOD	4,021	14,031	2,456
07-103- LTP-SS26j	In situ	36	<LOD	64	65	132
07-103- LTP-SS26j	10m sieve	17	<LOD	<LOD	40	113
07-103- LTP-SS26j	10m sieve CLP	18.4	0.26	23.0	55.7	118
07-103- LTP-SS27a	In situ	<LOD	<LOD	1,841	5,164	1,471
07-103- LTP-SS27b	In situ	<LOD	<LOD	3,245	29,530	2,948
07-103- LTP-SS27c	In situ	<LOD	<LOD	217	405	222
07-103- LTP-SS27c	10m sieve	<LOD	<LOD	189	402	207
07-103- LTP-SS27c 6"	10m sieve	<LOD	<LOD	1,211	2,128	376
07-103- LTP-SS27d	In situ	<LOD	<LOD	540	3,707	219
07-103- LTP-SS27e	In situ	<LOD	<LOD	3,876	21,253	3,367
07-103- LTP-SS27f	In situ	<LOD	<LOD	78	134	137
07-103- LTP-SS28a	In situ	<LOD	<LOD	845	3,764	375
07-103- LTP-SS28b	In situ	<LOD	<LOD	1,458	10,327	916
07-103- LTP-SS28b 12"	10m sieve	<LOD	<LOD	551	1,054	168
07-103- LTP-SS28c	In situ	<LOD	<LOD	444	1,368	352
07-103- LTP-SS28d	In situ	<LOD	<LOD	172	612	155

**TABLE 4-1
LOWER TAILINGS PILE SAMPLE RESULTS**

		Arsenic	Cadmium	Copper	Lead	Zinc
XRF Limits of Detection (mg/kg)		20	NC	21	22	29
Sample Number	Sample State	Results (mg/kg)				
07-103- LTP-SS28d	10m sieve	<LOD	<LOD	164	538	131
07-103- LTP-SS28e	In situ	<LOD	<LOD	96	331	127
07-103- LTP-SS29a	In situ	<LOD	<LOD	2,209	5,854	845
07-103- LTP-SS29b	In situ	<LOD	<LOD	303	948	260
07-103- LTP-SS29b 6"	10m sieve	<LOD	<LOD	432	1,133	215
07-103- LTP-SS29c	In situ	<LOD	<LOD	165	473	212
07-103- LTP-SS29c	10m sieve	<LOD	<LOD	170	403	165
07-103- LTP-SS29d	In situ	<LOD	<LOD	235	1,035	174
07-103- LTP-SS29e	In situ	<LOD	<LOD	<LOD	127	83
07-103- LTP-SS30a	In situ	<LOD	<LOD	1,083	6,909	1,062
07-103- LTP-SS30b	In situ	<LOD	<LOD	1,283	4,611	419
07-103- LTP-SS30c	In situ	<LOD	<LOD	106	662	190
07-103- LTP-SS30c	10m sieve	<LOD	<LOD	78	242	111
07-103- LTP-SS31a	In situ	<LOD	<LOD	1,865	5,381	903
07-103- LTP-SS31b	In situ	29	<LOD	179	105	235
07-103- LTP-SS31b	10m sieve	<LOD	<LOD	87	180	135
07-103- LTP-SS31bD	10m sieve	<LOD	<LOD	72	154	128
07-103- LTP-SS32a	In situ	<LOD	<LOD	2,886	6,277	2,242
07-103- LTP-SS32b	In situ	<LOD	<LOD	198	940	541
07-103- LTP-SS32c	In situ	<LOD	<LOD	<LOD	82	333
07-103- LTP-SS32c	10m sieve	<LOD	<LOD	128	190	446
07-103- LTP-SS33a	In situ	215	<LOD	2,228	5,596	752
07-103- LTP-SS33b	In situ	82	<LOD	562	1,074	507
07-103- LTP-SS33c	In situ	82	<LOD	375	946	327
07-103- LTP-SS33d	In situ	<LOD	<LOD	71	167	167
07-103- LTP-SS33d	10m sieve	<LOD	<LOD	71	183	327
07-103- LTP-SS33d	10m sieve CLP	17.4	1.7	69.8	219	418
07-103- LTP-SS34a	In situ	<LOD	<LOD	2,425	5,617	1,079
07-103- LTP-SS34b	In situ	86	<LOD	805	1,656	753
07-103- LTP-SS34c	In situ	<LOD	<LOD	773	2,002	925
07-103- LTP-SS34d	In situ	<LOD	<LOD	181	446	361
07-103- LTP-SS34d	10m sieve	<LOD	<LOD	181	384	333

Notes:

-- Not available
 CLP Contract Laboratory Program
 <LOD Less than XRF detection limit
 NC Not calculated
 mg/kg Milligrams per kilogram
 CLP Validated Results
 NA Not applicable
 XRF X-Ray Fluorescence
 10m #10 mesh (2 millimeter opening)

**TABLE 4-2
LOWER TAILINGS PILE DEPTH SAMPLE RESULTS**

		Arsenic	Cadmium	Copper	Lead	Zinc
XRF Limits of Detection (mg/kg)		20	NC	21	22	29
Sample Number	Sample State	Results (mg/kg)				
07-103- LTP-MW05-03-9'-9.5'	10m sieve	<LOD	<LOD	208	199	528
07-103- LTP-MW5-03-9'-9.5'D	10m sieve	<LOD	<LOD	214	158	436
07-103- LTP-MW5-04-11'-11.7'	10m sieve	<LOD	<LOD	122	131	688
07-103- LTP-MW6-20'-22'	10m sieve	<LOD	<LOD	499	1,152	629
07-103- LTP-SB1-01-23.5'-24.3'	10m sieve	<LOD	<LOD	144	367	352
07-103- LTP-SB2-01-20'-21'	10m sieve	<LOD	<LOD	42	117	211
07-103- LTP-SB2-01-20'-21'	10m sieve CLP	4.2	0.74	44	109	216
07-103- LTP-SB3-01-17.1'-17.7'	10m sieve	<LOD	<LOD	370	622	701
07-103- LTP-SB4-01-17'-18'	10m sieve	<LOD	<LOD	60	98	190
07-103- LTP-SB5-01-10'-10.5'	10m sieve	<LOD	<LOD	241	555	758
07-103- LTP-SB6-01-10.5'-11.3'	10m sieve	<LOD	<LOD	54	162	245
07-103- LTP-TP01-8'	10m sieve	<LOD	<LOD	1,053	1,789	981
07-103- LTP-TP03-7'	10m sieve	<LOD	<LOD	527	1,134	776
07-103- LTP-TP04-3'-4'	10m sieve	<LOD	<LOD	731	1,874	735
07-103- LTP-TP05-1.5'-2.0'	10m sieve	<LOD	<LOD	43	210	303
07-103- LTP-TP06-3.5'-4.0'	10m sieve	<LOD	<LOD	580	1,387	886
07-103- LTP-TP07-2'-3'	10m sieve	<LOD	<LOD	623	1,493	902
07-103- LTP-TP07-2'-3'	10m sieve CLP	15	5.3	501	1,760	858
07-103- LTP-TP08-2'-3'	10m sieve	<LOD	<LOD	99	190	519
07-103- LTP-TP09-5.5'-6.0'	10m sieve	<LOD	<LOD	911	2,303	955
07-103- LTP-TP09-5.5'-6.0'D	10m sieve	<LOD	<LOD	875	2,387	966
07-103- LTP-TP10-3.5'-4'	10m sieve	<LOD	<LOD	203	770	456
07-103- LTP-TP11-3.5'-4'	10m sieve	<LOD	<LOD	671	1,612	601

Notes:

-- Not available
 CLP Contract Laboratory Program
 <LOD Less than method limit of detection
 NC Not calculated
 mg/kg Milligrams per kilogram
 CLP Validated Results
 NA Not applicable
 XRF X-Ray Fluorescence
 10m #10 mesh (2 millimeter opening)

TABLE 5-1
VOLUME ESTIMATES FOR UPPER AND LOWER TAILINGS PILES

	Existing Grade Surface Area		Waste Surface Area		Estimated Removal Volume	Depth of Removal	Possible Additional Excavation
	SF	Acres	SF	Acres	CY	Ft	CY
Upper Tailings Pile	356,000	8.17	320,000	7.35	91,000	0-32	12,000
Lower Tailings Pile	517,000	11.87	517,000	11.87	176,000	0-31	20,000

Notes:

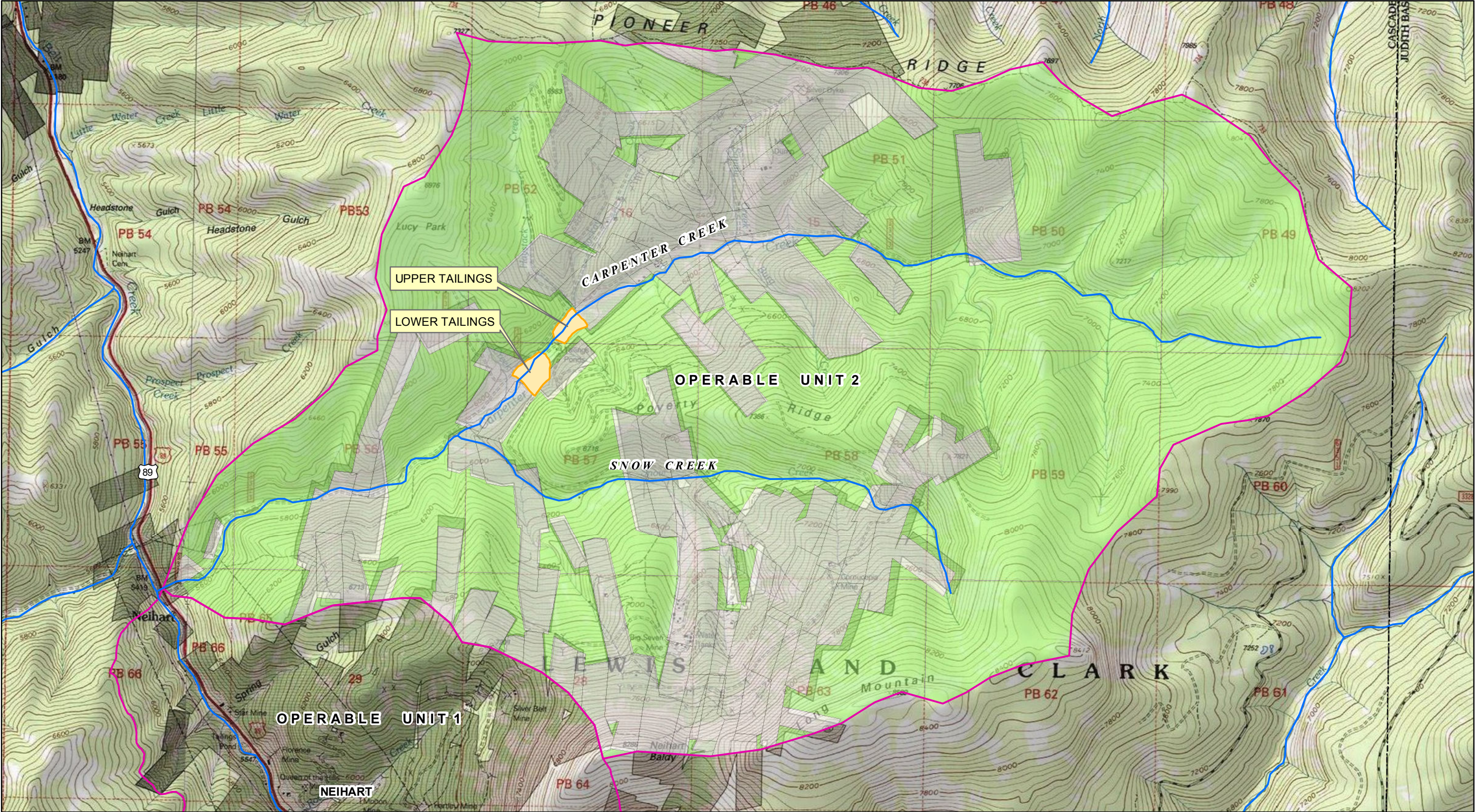
SF Square Feet

CY Cubic Yard

Ft Feet

Possible Additional
Excavation Estimate based on excavating an additional 1 foot of material below the entire waste surface

FIGURES



LEGEND

TAILINGS PILE EXTENTS

OPERABLE UNIT BOUNDARIES

STREAMS

PRIVATE LANDS

NATIONAL FOREST LANDS

BING 2010 SATELLITE IMAGE

1,00001,000

SCALE IN FEET

N

CARPENTER SNOW CREEK SUPERFUND SITE

FIGURE 1-1
SITE LOCATION

TE

TETRA TECH, INC.



LEGEND

 OPERABLE UNIT BOUNDARIES

 LOWER TAILINGS PILE EXTENT

 CARPENTER CREEK ROAD

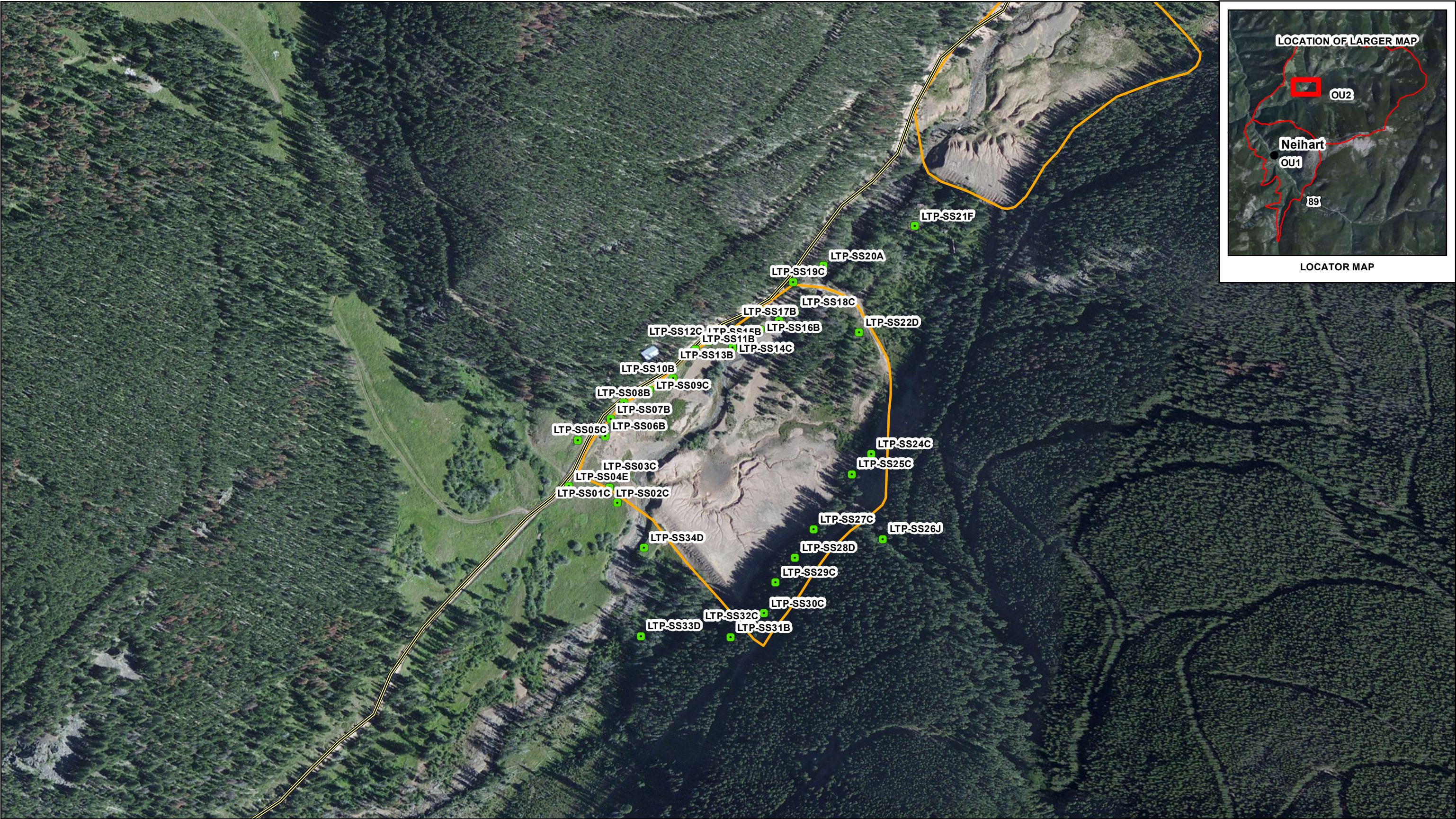
BING 2010 SATELLITE IMAGE



CARPENTER SNOW CREEK SUPERFUND SITE

FIGURE 2-1
TAILINGS PILES LOCATIONS





LEGEND

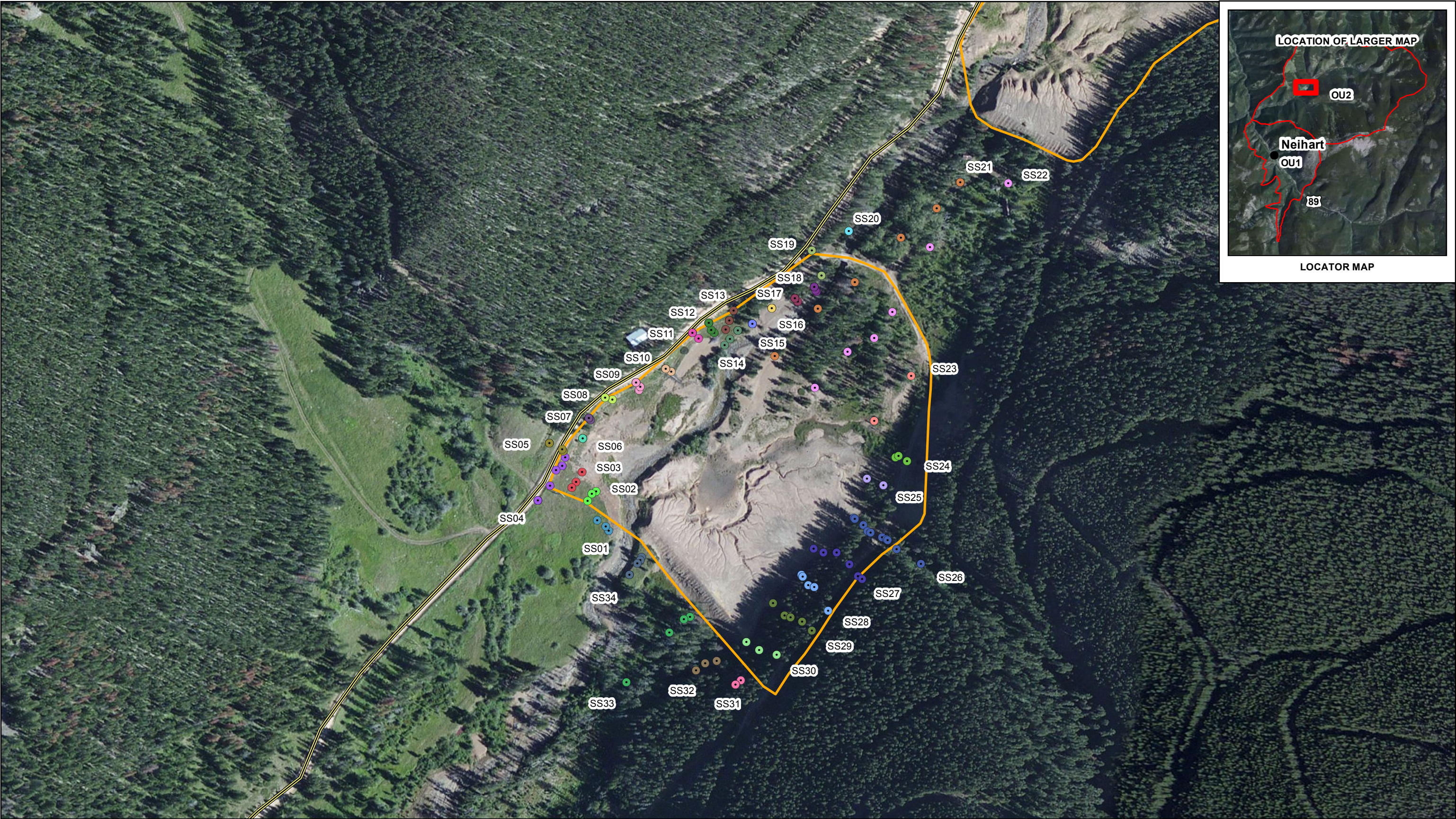
- | | |
|--|--|
|  SURFACE SOIL SAMPLE POINTS |  LOWER TAILINGS PILE EXTENT |
|  OPERABLE UNIT BOUNDARIES |  CARPENTER CREEK ROAD |
| BING 2010 SATELLITE IMAGE | |



CARPENTER SNOW CREEK SUPERFUND SITE

FIGURE 3-1
SURFACE SOIL SAMPLE LOCATIONS





LEGEND

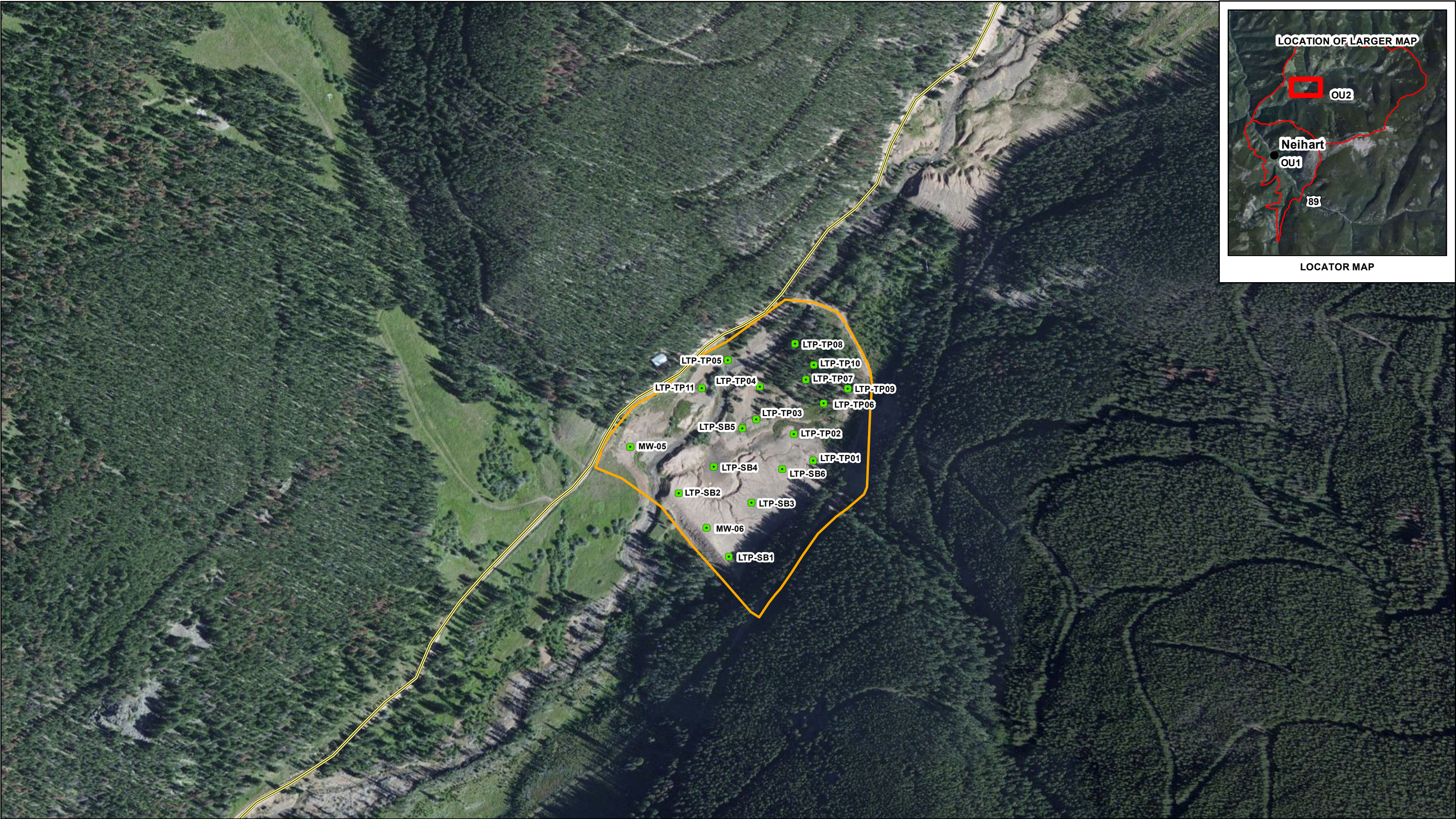
- SURFACE SOIL SAMPLE POINTS
MAPPED BY GROUP
NOTE: SAMPLE A FOR EACH LOCATION WAS
COLLECTED CLOSEST TO THE CENTER OF
THE TAILINGS PILE. SAMPLING PROCEEDED
OUTWARD FROM THAT LOCATION (A, B, C, D, ETC.)
- OPERABLE UNIT BOUNDARIES
- LOWER TAILINGS PILE EXTENT
- CARPENTER CREEK ROAD
- BING 2010 SATELLITE IMAGE



CARPENTER SNOW CREEK SUPERFUND SITE

FIGURE 3-2
INSITU XRF SAMPLE LOCATIONS

TETRA TECH EM, INC.



LEGEND

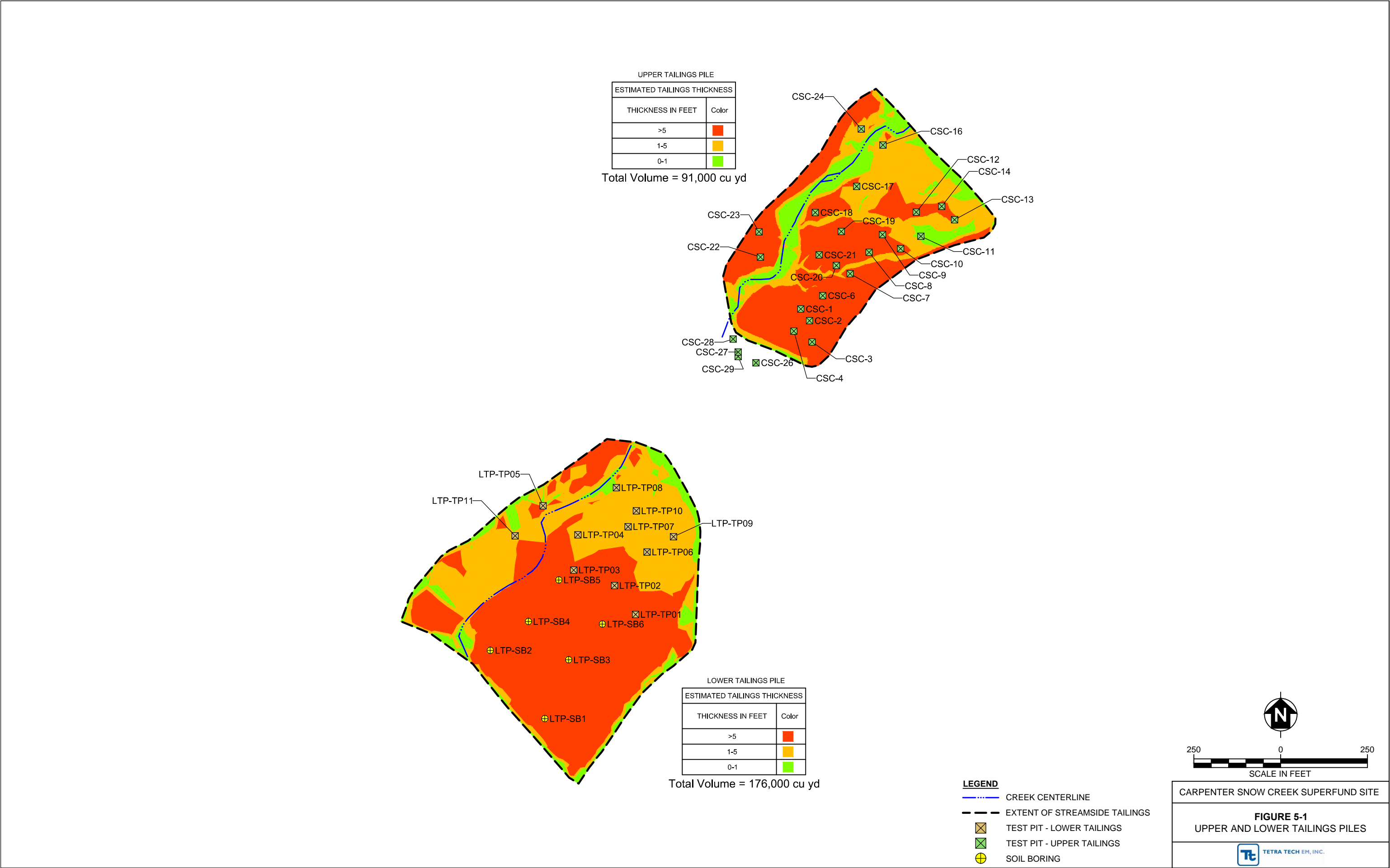
- | | |
|--|--|
|  SURFACE SOIL SAMPLE POINTS |  LOWER TAILINGS PILE EXTENT |
|  OPERABLE UNIT BOUNDARIES |  CARPENTER CREEK ROAD |
| BING 2010 SATELLITE IMAGE | |



CARPENTER SNOW CREEK SUPERFUND SITE

FIGURE 3-3
TEST PIT AND BOREHOLE LOCATIONS





APPENDIX A
COMPLETE SAMPLE RESULTS
(Attached CD)

APPENDIX B
BORELOG AND TEST PIT FIELD FORMS
(Attached CD)

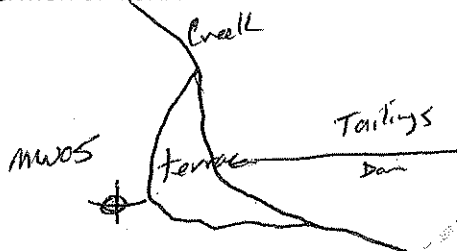
BOREHOLE LOG



Tetra Tech Inc.

SHEET ____ OF ____

LOCATION OF BOREHOLE



JOB NO.:	BOREHOLE DESIGNATION: MW-5
CLIENT:	SURFACE ELEVATION:
SITE:	DEPTH TO WATER:
SUBSITE:	LOGGED BY: D. Shalun
DRILLING CO: BOLD	DRILLING DATES: 8/30/2011
DRILLING PERSONNEL/METHOD: Chris/Kevin/AAA	

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYSICAL	CHEMICAL			
						1430						<p>Drill through tailings at surface until out of tails into gravel</p> <p>3.0 - 3.5 GRAVEL (tailings), streaked throughout, very coarse, broken granitics</p> <p>3.5 - 5.0 - NR</p> <p>5.0 - 7.0 SAND, coarse to medium, gray to orange-brown, silty clayey</p> <p>Gravels from 5.0 - 6.0, very coarse, sharp grad w/</p> <p>7.0 - 7.8 As above, multi-colored medium sand, clayey, black layer at 7.8</p> <p>7.8 - 8.0 - CLAY, black, dense</p> <p>8.0 - 9.0 - NR</p> <p>9.0 - 9.5 SAND, dk gray, silty clayey w/ scattered granitic frags, wet SAMPLE MWS-03</p> <p>9.5 - 11.0 NR</p> <p>11.0 - 11.7 SAND w/ PRA GRAVEL, varied colors in grains, very coarse sand or rounded gravels up to 0.5", loose, some staining.</p> <p>11.7 - 13.0 - NR</p> <p>13.0 - 13.8 SAND, coarse to v. coarse, cobble occasion, loose, wet, no clay, lt colored qtz</p> <p>13.8 - 15.0 - NR</p> <p>15.0 - 15.5 Broken Bdrk, angular (metallurgical) granitics</p> <p>15.5 - 17.0 - NR</p>

5-15 0.010 1.0-3.5 Bent chips
3.5-15 1/20 SAND 5.0 = 2.5'



SHEET 1 OF 2

LOCATION OF BOREHOLE

Carpenter Creek

x
mwb

Tailings pile

BOREHOLE DESIGNATION: M6 MW-1b

SURFACE ELEVATION:

DEPTH TO WATER:

LOGGED BY: C. McCay

DRILLING DATES: 9-1-11

DRILLING PERSONNEL/METHOD:

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT.						PHYSICAL	CHEMICAL			
SS			1	9"	8"	08:56						Start drilling drill to 15'
												15' tailings getting wet
												15-17 1/2' Tailings at top bottom sand collect sample MW6 15-17
												9" light brown in color Material soft, proceed to 20'
SS			5	11"	2'							20' Material soft → tailings, proceed to 25' hit something hard. Collect sample MW6 20-21 1/2'
			11									3" brown/gray tailings/sand
			10									8" crushed black/white rock
			6									1" rock orange/green Wet Proceed to 25'
SS			4	18"	2'							25' Collect sample MW
			6									3" black/gray sand
			8									8" crushed gravel
			6									1" yellow/orange rock 1" gray rock 3" crushed gravel
SS			5	11"	2'							26' Boto refusal collect sample
			11									6" Coarse black sand with orange material mixed in
			13									2" rock
			30									2" coarse sand/fine gravel 1" rock white & yellow



SHEET 2 OF 2

[illegible]

TEST PIT LOG



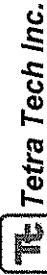
Tetra Tech Inc.

LT9-TP1

SHEET 1 OF 1

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087		TEST PIT DESIGNATION: TP-1	
				CLIENT: DEQ		SURFACE ELEVATION: ~	
				SITE: CSC - Lister Tailings		DEPTH TO WATER: NA	
				SUBSITE:		LOGGED BY: CRR	
				EXCAVATION CO.: Olympus Technical Services		DATE: 8-29-11	
SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
Grab	8-8.5		16:00	-		1	<p>Tailings</p> <p>Dark brown gravels</p> <p>max depth 8.5 hole casing could not get deeper</p>
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TEST PIT LOG



2TP-TP2

SHEET 1 OF 1

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087	TEST PIT DESIGNATION: TP-2
				CLIENT: DEQ	SURFACE ELEVATION:
				SITE: CSC - Lower Tailings	DEPTH TO WATER: -
				SUBSITE:	LOGGED BY: CRR
				EXCAVATION CO.: Olympus Technical Services	DATE: 8-29-11

SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
						1	<p>Tailings are very plastic, bowing in after every bucket collapsed completely at total depth of 9-10 feet</p> <p>Jerky backhoe suggesting gravel</p>
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

No Samples

TEST PIT LOG



Tetra Tech Inc.

LTP-TP3

SHEET 1 OF 1

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087		TEST PIT DESIGNATION: TP-3	
				CLIENT: DEQ		SURFACE ELEVATION: -	
				SITE: CSC - Lower Tailings		DEPTH TO WATER: -	
				SUBSITE:		LOGGED BY: Dem Shuler	
				EXCAVATION CO.: Olympus Technical Services		DATE: 8-30-11	
SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	SOIL DESCRIPTION	
	TOP	BOTTOM				DEPTH IN FEET	
						1	
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TP-3
0830hrs

Tailings, soft, or-gray, clays

Cobbles, rounded, sub-rounded cobbles, gravels, alluvial materials

TEST PIT LOG



Tetra Tech Inc.

LTTP-TP4

SHEET ____ OF ____

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087	TEST PIT DESIGNATION: TP-4		
CLIENT: DEQ				SURFACE ELEVATION:			
SITE: CSC - Lower Tailings				DEPTH TO WATER:			
SUBSITE:				LOGGED BY: D. Shaffer			
EXCAVATION CO.: Olympus Technical Services				DATE: 8-30-2011			
SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
						1	<p>Very thin layer (11') of orange tailings</p> <p>10-5.0 Coarse sub-rounded in silt-fine sand, brown</p> <p>TD = 6'</p>
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TP-4

0845hrs

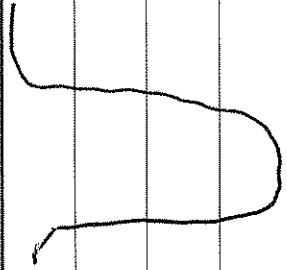
TEST PIT LOG



Tetra Tech Inc.

LTP-TPS

SHEET ____ OF ____

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087		TEST PIT DESIGNATION: <u>TPS</u>	
				CLIENT: DEQ		SURFACE ELEVATION:	
				SITE: CSC - Lower Tailings		DEPTH TO WATER:	
				SUBSITE:		LOGGED BY: <u>D. Shaler</u>	
				EXCAVATION CO.: Olympus Technical Services		DATE: <u>8/30/11</u>	
SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
						1	 <p>No tailings present in this TP</p>
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TP-5
1645

TEST PIT LOG



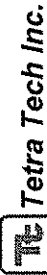
Tetra Tech Inc.

CTP-TP-6

SHEET ____ OF ____

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087		TEST PIT DESIGNATION: TP-6	
				CLIENT: DEQ		SURFACE ELEVATION:	
				SITE: CSC - Lower Tailings		DEPTH TO WATER:	
				SUBSITE:		LOGGED BY: D. Shaffer	
				EXCAVATION CO.: Olympus Technical Services		DATE: 8/30/2011	
SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS PHYSICAL CHEMICAL	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
			0925			1	<p>tailings, soft, tan, clayey</p> <p>some cobbles at 21'</p> <p>GRAVELS, dark sand, w/ cobbles</p> <p>boulders up to 1.5' dia. sand is med. to coarse-grnd</p>
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TEST PIT LOG



LTP-8P8

SHEET ____ OF ____

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087		TEST PIT DESIGNATION: TP-8	
CLIENT: DEQ				SURFACE ELEVATION:		DEPTH TO WATER:	
SITE: CSC - Lower Tailings				LOGGED BY: D. Shallen		DATE: 8/30/2011	
SUBSITE:				EXCAVATION CO.: Olympus Technical Services			

SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
			0855			1	<p>0.0-0.5 Tailings layer, thin 0.5-3.0 - gravels, cobbles, pebbles cobbles, sub-rounded, loose, brown, 70% gravels, 30% wet sands</p> <p>TD=3.0'</p>
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TEST PIT LOG



Tetra Tech Inc.

LTP-TP9

SHEET ____ OF ____

LOCATION OF BOREHOLE				EXCAVATION CO.: Olympus Technical Services			
JOB NO.: 103DS1613087				TEST PIT DESIGNATION: TP-9			
CLIENT: DEQ				SURFACE ELEVATION:			
SITE: CSC - Lower Tailings				DEPTH TO WATER:			
SUBSITE:				LOGGED BY: D. Shaffer			
				DATE: 8/30/2011			
SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
			0950				
						1	
						2	Tailing, or-brown, silty clays
						3	SAND, med qul, olive-gray, well-sorted, soft (tailings?) Sample
						4	
						5	SAND, black w/ or colored streaks, tails-like soft, wet
						6	SAND w/ cobble; pebble gravels
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TEST PIT LOG



Tetra Tech Inc.

CTP-TP-10

SHEET ____ OF ____

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087	TEST PIT DESIGNATION: TP-10
CLIENT: DEQ				SURFACE ELEVATION:	
SITE: CSC - Lower Tailings				DEPTH TO WATER:	
SUBSITE:				LOGGED BY: D. Shaffer	
EXCAVATION CO.: Olympus Technical Services				DATE: 8/30/2011	

SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
			1030			1	0.0-1.5 Tailings, soft silty, tan to orange tabular,
						2	--- e-layer
						3	1.5-1.9 SAND, gray, well-sorted, tails
						4	1.9-4.0 ORGANIC SOILS, black, wet water at 3'
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

TD = 4.0

TEST PIT LOG



Tetra Tech Inc.

CTP-TP11

SHEET ____ OF ____

LOCATION OF BOREHOLE				JOB NO.: 103DS1613087	TEST PIT DESIGNATION: TP-11
CLIENT: DEQ				SURFACE ELEVATION:	
SITE: CSC - Lower Tailings				DEPTH TO WATER:	
SUBSITE:				LOGGED BY: D. Shaffer	
EXCAVATION CO.: Olympus Technical Services				DATE: 8/30/11	

SAMPLE TYPE	SAMPLE DEPTH		TIME	PID READING	ANALYSIS	DEPTH IN FEET	SOIL DESCRIPTION
	TOP	BOTTOM					
			1050			1	0.0-1.5' Tails-OR-banded
						2	1.5-1.9' SAND, gray, likely tailings material
						3	1.9-5.0 SAND, black, some or streaks,
						4	soft, sl. clayey, mostly tails-free
						5	sample at ~ 4'
			1110			6	TP=5.0
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	

BOREHOLE LOG



Tetra Tech Inc.

SHEET ____ OF ____

LOCATION OF BOREHOLE

JOB NO.:

BOREHOLE DESIGNATION: SB-1

CLIENT:

SURFACE ELEVATION:

SITE:

DEPTH TO WATER:

SUBSITE: Lower TailingsLOGGED BY: D. GaffneyDRILLING CO.: BolanyDRILLING DATES: 9/2/2014

DRILLING PERSONNEL/METHOD:

Brian Chuck / HSA Track Rig

mw SB-1

Tailings 'Dam'

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT.						PHYSICAL	CHEMICAL			
						1045						Drill to 23.5' before cut & soft tailings.
						1120						23.5 - 24.3 - GRAVEL w/ coarse SAND, gravels are sub-rounded (80%) coarse sub-rounded pebbles gravel, loose, wet, dk gray generally <u>SAMPLES: SB01-01</u>
												24.3 - 25.5 NR <u>1130</u>
						1150						25.0 - 26.5 GRAVELS as above <u>23.5-24.3</u> black layer of med sand at 26.5 - 26.7 (tails)
												26.5 - 27.0 GRAVEL w/ coarse sand gravel is sub-rounded w/ or - coloration, pebbles up to 1", loose <u>SAMPLES:</u>
						1215						27.0 - 28.4 - GRAVEL <u>SB01-02</u> w/ SAND, gravel is 26.5 - 27.0 sub-angular to broken, varied colors, sand is coarse (20%), no evidence of tailings in matrix. <u>1150</u>
												<u>SAMPLES: SB01-03</u>
						1225						28.4 - 29 - NR <u>1220</u>
												TD = 29' <u>27.5-28.4</u>

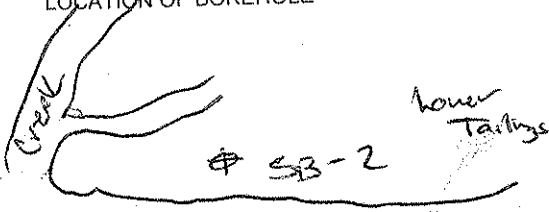
BOREHOLE LOG



Tetra Tech Inc.

SHEET ____ OF ____

LOCATION OF BOREHOLE



JOB NO.:	BOREHOLE DESIGNATION: SB-2
CLIENT:	SURFACE ELEVATION:
SITE:	DEPTH TO WATER:
SUBSITE:	LOGGED BY: D. Shaffer
DRILLING CO.:	DRILLING DATES: 9-1-2011
DRILLING PERSONNEL/METHOD:	
Chuck Track Rig HSA	

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYSICAL	CHEMICAL			
						1505						Drill to 15', start sample 15'
												15.0-16.2 - SAND, Bn, v. clayey, olive brown, wet, sharp contact w/ black material below
												16.2-16.4 ORGANIC, wood, SAND, damp, wood, debris(?)
						1520						16.4-17. NR
												17.0-17.2 very little recovery, woody debris dk gray, wet
												17.2-19.0 NR
												19.0-20.0 NR
						1540						20.0-22.0 - SAND w/ GRAVEL, sand is dk gray, w/ iron staining, angular, coarse grading
												SAMPLE: SB02-01 1535 20.0-21.0
						1605						22.0-21.2 SAND & GRAVEL (as above) pebble gravel w/ very coarse sand dk gray to varied colors, coarse sand, loose, wet, no clay
												SAMPLE SB02-02 1615
												21.2-22. NR
												22-24- Gravel varied colors, broken, some angular, v.L. sand.
						1650						TD of hole = 24'

SHEET OF _____

LOCATION OF BOREHOLE

JOB NO.:

BOREHOLE DESIGNATION: SBO3

CLIENT:

SURFACE ELEVATION:

SITE:

DEPTH TO WATER:

SUBSITE: Lower Tailings

LOGGED BY: D. Shaker

DRILLING CO.: Boland

DRILLING DATES: 9/2/2011

DRILLING PERSONNEL/METHOD:

Brian, Chuck/HSA Track Rig

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYSICAL	CHEMICAL			
						0905						Drill to 10'. Drill to 14' wheelbit first gravel. Start sample.
						0930						14.6 - 16.6 NR sand at bottom, br med. gnd, well sorted.
												16.6 - 17.1 - GRAVELS w/ SAND, sub- angular gravels (70%) in coarse sand, dk gray. Sharp contrast w/ on-stained sand and gravels below
												17.1 - 17.7 GRAVELS w/ SAND - on black sand and angular gravels, broken, longer than above
						0950						17.7 - 18.5 - NR <u>SAMPLE 1: SP03-01</u> 0950
						1000						18.5 - 18.9 - SAND, coarse gnd, well-sorted, dk gray and multi- colored, loose, wet, 17.1 - 17.7
												18.9 - 19.9 GRAVELS w/ coarse sand, gravels are broken, angular to sub- angular, loose, 100 gr.
												<u>SAMPLE 3: SP03-02</u> 1005
						1010						TD of hole 20.5' 18.9 - 19.9

BOREHOLE LOG



Tetra Tech Inc.

SHEET 1 OF 2

LOCATION OF BOREHOLE

SB05

Gully

SB04

JOB NO.:

BOREHOLE DESIGNATION: SB04

CLIENT:

SURFACE ELEVATION:

SITE:

Carpenter Creek

DEPTH TO WATER:

SUBSITE:

Lower Tarlings

LOGGED BY: D. Shadler

DRILLING CO.: Roland

DRILLING DATES: 8/29/2011

DRILLING PERSONNEL/METHOD:

Chris, Kevin / HSA

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYSICAL	CHEMICAL			
						1508						DRILL TO 15', then start driving samples 0-5' from cutting, sand (tails) soft gray to orange brown 5-10 As above, lt brown, clayey 10-15 As above, something hard at 15' 15.0 - (big spoon hits refusal) 2" dark SAND at tip of spoon, or-colored tails - no sample. 2nd drive, no recovery. Drill 2', then drive. 17.0 - 18.0 SAND, very coarse, varred colored grains, weathered igneous - crystalline, some rounded cobbles, loose, wet. SAMPLE: SB04-01 1540 17-18' 19.0 - 19.5 - GRAVEL (SAND, lt orange to gray to dk gray, tarlings-like 19.5 - 20.0 - NR SAMPLE: SB04-02 1545 20.0 - 20.5 GRAVEL rounded 19.0 - 19.5 w/ very coarse sand (50%) 20.5 - 21 - NR 21.0 - 21.6 GRAVELS, coarse broken boulder or bedrock crystals, some or-brown staining (tails?) could not get center bit rod back down, end drilling thunder, lightning, end drill
						1600						
						1640						

BOREHOLE LOG



Tetra Tech Inc.

SHEET 2 OF 2

LOCATION OF BOREHOLE

JOB NO.:

BOREHOLE DESIGNATION: SB04 (cont)

CLIENT:

SURFACE ELEVATION:

SITE:

DEPTH TO WATER:

SUBSITE:

LOGGED BY: D. Shaffer

DRILLING CO.:

DRILLING DATES: 8/30

DRILLING PERSONNEL/METHOD:

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYSICAL	CHEMICAL			
						1210						Storage 20' - drill to 20'
						1230						
												20.0 - 20.5 Broken gravels, cobbles, angular, no bails observed, some coarse sand
												SAMPLE: SB04-04 1230
												Drill to 23' through boulder, attempt smaller split spoon for sample
												23.0 - 24.5 Gravels and broken cobbles pebble gravel (40%) sub rounded to rounded
												SAMPLE: SB04-05
						1300						24.5 - 25.0 NR 1250
												23.0 - 24.5
												Drove to 25'
												Drill to 23'
												* measured WL w/ augers in hole = 23' bgs

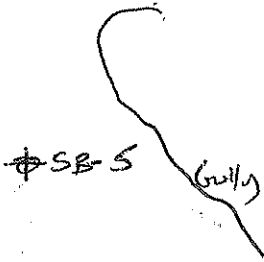
BOREHOLE LOG



Tetra Tech Inc.

SHEET 1 OF 2

LOCATION OF BOREHOLE



JOB NO.:	BOREHOLE DESIGNATION: SB-05
CLIENT:	SURFACE ELEVATION:
SITE: Carpenter Creek	DEPTH TO WATER:
SUBSITE: Lower Tailings	LOGGED BY: D. Shale
DRILLING CO.: Bejan	DRILLING DATES: 8/29/2011
DRILLING PERSONNEL/METHOD: HSA / Chris, Kevin	

SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYSICAL	CHEMICAL			
						1220						*Drill to 10' then begin continuous sample from 10' SAND @ 5' in cuttings 5-10 (cuttings) SAND, clayey, lt brown, moist 10.0 (difficult hammering) - 10.5 - COBBLES, drove through. Appears alluvial, dark olive - gray sand, clayed at 10.4' Sample SB05-01 1240hrs 10.0-10.5' [re-try w/ smaller spoon] 2nd spoon - dk gray sand, sl. clayey, w/ pink, broken granitic at 10.5' 13.0 - 14.5 SAND, coarse to very coarse, weathered granitic, angular, fairly well-sorted, wet, iron stained, appears like tailings SAMPLE: SB-05-02 1305 13.0-14.5' 14.5-15.0 - NR 15.0-16.3 - SAND, coarse, varied colors, med sand to coarse, orange - stained appears to be tailings. SAMPLE: SB05-03 1315 15.0-16.3
						1316						



SHEET 2 OF 2

LOCATION OF BOREHOLE										JOB NO.:		BOREHOLE DESIGNATION: <u>SB05 (cont)</u>	
										CLIENT:		SURFACE ELEVATION:	
										SITE:		DEPTH TO WATER:	
										SUBSITE:		LOGGED BY:	
										DRILLING CO.:		DRILLING DATES: <u>8/29/2011</u>	
										DRILLING PERSONNEL/METHOD:			
SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION	
	TOP	BOT						PHYSICAL	CHEMICAL				
						1320						17.0-18.2 SAND & broken, weathered granitic crystalline grains, heavily oxidized, black streaks	
												<u>SAMPLE: SB05-04</u> 1335 1335 17.8-18.2	
						1348						18.2-19.0-NR continue to drill to 19', then drive	
												19.0-20.3- SAND, coarse w/ some rounded gravels starting to appear, or-staining and some black sands, appears tailings-like, keep drilling.	
												<u>SAMPLE SB05-05</u> 1350 19.5-20.3	
												20.3-21.0-NR	
												21.0-22.0 As above, or-staining still in matrix, fewer dk-stained & whites, loose	
												<u>SAMPLE: SB05-06</u> 1355 21.0-22.0	
						1415						drill to 23, drive 23'-25'	
												23.0-23.6 SAND, med, gray to dk gray w/ broken, angular cobbles grades to coarser broken bedrock and bedrock frags, consistent.	
												23.6-25.0 Bdprou, broken, weathered, brown to sl. or-brown, not apparent tailings,	
												TD=25' <u>SAMPLE: SB05-07</u> 1420 hrs, 24-25'	



SHEET OF

LOCATION OF BOREHOLE										JOB NO.: _____		BOREHOLE DESIGNATION: SBOL6	
<p>A hand-drawn sketch shows a winding path or road labeled "road". A point on the right side of the road is marked with a circle and labeled "SBOL6". To the left of the road, there's a feature labeled "creek". The entire area is enclosed in a rectangular box.</p>										CLIENT: _____		SURFACE ELEVATION: _____	
										SITE: _____		DEPTH TO WATER: _____	
										SUBSITE: _____		LOGGED BY: D. Shaffer	
										DRILLING CO.: Bolander		DRILLING DATES: 9/2/11	
										DRILLING PERSONNEL/METHOD:			
										Brian Chubb / HSA Tracking			
SAMPLE TYPE	SAMPLE DEPTH		BLOWS PER 6 INCHES	RECOVERED	DRIVEN	TIME	PID READING	ANALYSIS		DEPTH IN FEET	GRAPHIC LOG	SOIL DESCRIPTION	
	TOP	BOT						PHYSICAL	CHEMICAL				
						0820						Drill to 10'	
												10.5 - 10.8 - SAND, dk brown, well-sorted, loose, no gravels (tailings)	
												10.8 - 11.0 - SAND, black, well-sorted, wet, loose, no gravels (tails) contact with sandy gravel below.	
												11.0 - 11.3 GRAVEL, angular, w/ med. to coarse sand, some coloration, angular pebbles, loose, no clay, multi-colored gravels.	
												SAMPLES: SBOL6-01 0810	
						0826						11.3 - 12.0 NR 10.5 - 11.3	
												12.0 - 12.3 - (crushed boulder)	
												12.3 - 12.5 - SAND, ori, dk gray to dk gray, w/ sub-angular gravel, sand is med to coarse, loose,	
												12.5 - Bot SAND & BROKEN, ANGULAR GRAVELS, sand is dark-on-black.	
												SAMPLES: SBOL6-02 0830	
						0833						12.5 - 12.8	
												13.1 - 14 - NR	
												14.0 - 14.7 - GRAVELLY SAND, sand is dk brown, gravels are angular-to-subangular, very wet, well-graded	
												SAMPLES: SBOL6-03 0840	
												TD = 16.0' by 14.0 - 14.7	